

ACCESSION #: 9902120157

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Prairie Island Nuclear PAGE: 1 OF 4

Generating Plant Unit 1

DOCKET NUMBER: 05000282

TITLE: Reactor Trip Following Failure of the Station Auxiliary
Transformer

EVENT DATE: 01/05/99 LER #: 99-01-0 REPORT DATE: 02/04/99

OTHER FACILITIES INVOLVED: Prairie Island Unit 2 DOCKET NO: 05000306

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Jack Leveille TELEPHONE: (651) 388-1121

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: EA COMPONENT: XFMR MANUFACTURER: W120

REPORTABLE TO EPIX: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At approximately 1311 on January 5, 1999, with Unit 1 operating at 100% power and no electrical switching in progress an internal fault occurred in the Unit 1 Main (1M) transformer. The fault caused an explosion in the transformer and Unit 1 Turbine Trip / Reactor Trip. As a result of the explosion, the 1M transformer was breached and a large was expelled and ignited in an area approximately 40 feet north of the transformer. The

Fire Brigade was spa the site and extinguished the burning oil fire at approximately 1325. As a result of the fault, explosion, and fire, both 1M and 1R (Unit 1 reserve transformer) were locked out. This caused the loss of non-safeguards buses 11, 12, 13, & 14 and major equipment on Unit 1 powered from these buses including both reactor coolant pumps (RCPs), both feedwater pumps, both circulating water pumps, all condensate pumps, all heater drain pumps, 11 cooling water pump, all Turbine Building and Auxiliary Building lighting (except for battery backed emergency lighting), motor driven fire pump, spent fuel pool cooling, and a loss of all non-safeguards 480V buses fed from these buses. With the loss of both RCPs, Unit 1 was on natural circulation. No diesel generators started. One safeguards bus was never lost, the other successfully transferred sources automatically. After the initial response to the event was completed and the unit stabilized, power was restored to non-safeguards 4KV buses and the RCPs were restarted between 7 and 8 hours following the transformer fault. The unit was restored to normal power operation over the following week.

TEXT PAGE 2 OF 13

EVENT DESCRIPTION

At approximately 1311 on January 5, 1999, with Unit 1 operating at 100% power and no electrical switching in progress an internal electrical fault occurred in the Unit 1 Main (1M) transformer 1_/. The fault caused an explosion in the transformer and an automatic Unit 1 Turbine Trip / Reactor Trip. A narrative description follows, for a detailed sequence of events, see the separate section called Sequence of Events, just prior to the figures.

Explosion/Fire Events

As a result of the explosion the 1M transformer tank was breached and a large amount of oil was expelled from the transformer to an area approximately 40 feet north of the transformer. This oil was ignited during the process and continued to burn while on the ground. A second internal explosion in the transformer expelled additional oil into the area of the original fire. Directly above where the fire was burning was a

transmission tower 2_ / with 161 KV lines 3_ / from the site substation to the Unit 1 Reserve (1R) transformer 4_ /. The initial ground fire had flames approximately 40 feet high with dense black smoke. Shortly after the explosion the control room dispatched the site Fire Brigade. The Fire Brigade responded to the area of the fire and extinguished the burning oil fire before the Red Wing Fire Department arrived.

General Plant Response Resulting from Failure of 1M Transformer

The Unit 1 electrical line up (for reference, see Figures 1, 2, and 3) before the event was as follows: 4KV safeguards Bus 5_ / 15 supplied from 1R transformer, 4KV safeguards Bus 16 supplied from Cooling Tower (CT) 11 transformer, 4KV Bus 11 and 12 supplied from 1M transformer, 4KV Bus 13 and 14 supplied from 1M transformer, safeguards 480 volt buses 6_ / supplied from Bus 15 & 16, non-safeguards 480 volt buses supplied from Buses 13 and 14. 1M transformer locked out as a result of the fault and all protective relaying functioned as intended. The dense smoke and flames from the fire caused a phase to phase fault between the B and C phases of the 161 KV lines causing a lock out of the 1R transformer. The loss of both the 1R and 1 M transformers caused the loss of non-safeguards buses 11, 12, 13 & 14 and major equipment on Unit 1 powered from these buses including both reactor coolant pumps 7_ / (RCPs), both feedwater pumps 8_ /, both circulating water pumps 9_ /, all condensate pumps 10_ /, all

1_ / EIIS System Identifier: EA; Component Identifier: XFMR

2_/ EIIS System Identifier: EA; Component Identifier: TWR

3_/ EIIS System Identifier: EA; Component Identifier: CBL

4_/ EIIS System Identifier: EA; Component Identifier: XFMR

5_/ EIIS System Identifier: EB; Component Identifier: BU

6_/ EIIS System Identifier: EC; Component Identifier: BU

7_/ EIIS System Identifier: AB; Component Identifier: P

8_/ EIIS System Identifier: SJ; Component Identifier: P

9_/ EIIS System Identifier: KE; Component Identifier: P

10_/EIIS System Identifier: SD; Component Identifier: P

TEXT PAGE 3 OF 13

heater drain pumps 11_/, 11 cooling water pump 12_/, all Turbine Building and Auxiliary Building lighting 13_/ (except for battery backed emergency lighting 14_/), motor driven fire pump 15_/, spent fuel pool cooling 16_/, and a loss of all non-safeguards 480V buses fed from these buses. With the loss of both RCPs, Unit 1 was on natural circulation. No diesel generators started.

After the initial response to the event was completed and the unit stabilized efforts were started to restore power to non-safeguards buses 11, 12, 13 and 14. Buses 13 and 14 were restored from the 2RY source followed by restoration of the 480V buses 130, 140, 150, 160 and 180. This restored power to the lighting and auxiliaries. Power was restored to buses 11 and 12 from the 2RX source and 11 and 12 RCPs restarted. Buses 15 and 16 were transferred to the 2RY source.

Over the next several days the following equipment inspections and testing were performed: 1R Transformer relay testing, 1R Transformer inspection, 1 R Transformer 161 KV cable and insulators repair, 1 Generator 17_ / inspection and testing, 1 Generator metering and regulating pot fuse testing, 1 Generator relay 18_ / cross tripping, 1 Generator and Generator Transformer relay testing, 1 Generator isophase bus duct 19_ / inspection, 1 Generator isophase bus duct ground strap 20_ / inspection, 1 Generator neutral grounding transformer inspection, First Out annunciators 21_ / testing, EH control system 22_ / testing, 1GT and 1R Transformers fire protection system 23_ / testing, Cooling Water System walkdown, load check of 1 Generator relay current transformers.

Also, over the next several days, the Unit 1 was returned to normal power operation January 12, 1999, with a normal electrical distribution except that 1M transformer isolated and out of service.

CAUSE OF THE EVENT

The cause of the event was a phase to phase fault on the 20 KV winding in 1M transformer. The disassembly of the transformer and root cause analysis will be done over the next several months.

11_ / EIIS System Identifier: SM; Component Identifier: P

12_ / EIIS System Identifier: BS; Component Identifier: P

13_ / EIIS System Identifier: FF

14_ / EIIS System Identifier: FH

15_ / EIIS System Identifier: KF; Component Identifier: P

16_ / EIIS System Identifier: DA

17_ / EIIS System Identifier: EL; Component Identifier: GEN

18_ / EIIS System Identifier: EL; Component Identifier: RLY

19_ / EIIS System Identifier: EL; Component Identifier: BDUC

20_ / EIIS System Identifier: EL

21_ / EIIS System Identifier: IB

22_ / EIIS System Identifier: JJ

23_ / EIIS System Identifier: KF

TEXT PAGE 4 OF 13

ANALYSIS OF THE EVENT

Safeguards equipment performed as expected:

Reactor protection

Reactor trip breakers

Electrical transfers

Auxiliary feedwater pump starts

Reactor coolant pump trips

Manual action was taken to control the event, including manual transfers of electrical sources, stopping the turbine driven auxiliary feedwater pump, fire fighting, controlling RCS temperature, pressure, chemistry, restart of the RCPs (see the event description for details).

Because of the proper functioning of the event mitigating equipment and the proper management of the event by plant personnel, health and safety of the

public was not affected.

This event is reportable under 10CFR50.73(a)(2)(iv) as an unplanned actuation of the reactor protection system, as the automatic actuation of the Safeguards Bus 15 sequencer, as the automatic start of 121 Cooling Water Pump, and the automatic starts of 11 and 12 auxiliary feedwater pumps. It is additionally reportable under 10CFR50.73(a)(2)(I)(B) as a condition prohibited by the plant's Technical Specifications (specifically the condition of no RCPs running when the RCS temperature was above 350 degrees F).

CORRECTIVE ACTION

Recovery of the unit from the event conditions is discussed in the event description.

During the day of the event plant personnel started clean up of the area where the transformer oil had burned. All remaining unburned oil, dirt, sod, and snow was scraped from the ground and placed in dumpsters for future disposal. About 2 inches of dirt that had been thawed out from the fire was removed. There appeared be no further penetration of oil into the ground. Soil samples will be taken in the spring when the ground has thawed to verify no oil soaked into the ground. The transformer pit drains were covered to minimize the spread of the remaining oil to the transformer bay collection pit. Sampling of the oil showed that PCBs were 2 parts per million.

Following the event, the equipment of concern was checked out for damage.

Power to Unit 1 was transferred from 2RX and 2RY to 1R Transformer (the Unit 1 reserve auxiliary transformer), the unit was returned to hot shutdown, taken critical, and returned to power on January 12, 1999.

Since the cause of the internal phase to phase failure of the transformer has not yet been determined, corrective actions to prevent recurrence are currently undetermined.

FAILED COMPONENT IDENTIFICATION

1M Transformer: Westinghouse Type SL Core Form Power Transformer Class
OA/FA/FA 40,000KVA

PREVIOUS SIMILAR EVENTS

Reactor trips have been experienced on both units. This was the first transformer failure to result in a trip.

SEQUENCE OF EVENTS

Approximately equal to 1311:22 - Fault occurs inside 1M transformer. The cause was a phase-to-phase fault on the 20KV winding. Fault current was supplied by Unit 1 Generator (1G) with no measurable contribution from the substation through 1GT. The fault caused both 1M Sudden Pressure and Differential instantaneous and time delay relay actuations on all three phases. These protective relays actuate the 1GT lockout relays.

1311:22.6 - 1GT lockout relays tripped Unit 1 Generator output breakers, field breaker, and transferred 4KV Buses 11, 12, 13, 14 to the Unit 1 Reserve (1R) transformer source.

1311:22.9 - Unit 1 Generator trip causes a Turbine trip.

1311:23.0 - Unit 1 Turbine trip causes a Unit 1 Reactor Trip. Both Rx trip breakers opened. Train A breaker opened at 13:11:22.977 and Train B breaker opened at 13:11:22:962.

1311:27 - 11 Turbine Driven and 12 Motor Driven Auxiliary Feedwater Pumps auto start.

1311:29.5 - 1R lockout relay actuation trips breakers 11-1, 12-1, 13-1, 14-4, 15-3, 16-2, and 1RYBT. This leaves 4KV Buses 11, 12, 13 and 14 de-energized. 480V Buses 130, 140, 150, 160, 180, 190, 310, 320 are also de-energized. Safeguards Bus 15 sequencer acts to re-energize Bus 15 from CT11 transformer. 480V Buses 111 and 112 are re-energized with Bus 15. (Note that Safeguards Bus 16 was initially powered from CT11 and continued to be powered from this source.)

TEXT PAGE 6 OF 13

Major equipment lost included both RCPs, both feedwater pumps, both circulating water pumps, all condensate pumps, all heater drain pumps, 11 cooling water pump, all Turbine Bldg and Aux Bldg lighting (except for battery backed emergency lighting), motor driven fire pump, and spent fuel pool cooling. (Note that, when both RCPs tripped, Unit 1 was on natural recirculation, later verified per 1ES-0.1 Attachment A.) No diesel generators started.

Entered 7 day LCO per Tech Spec 3.7.13.2 for Unit 1 safeguards power due to the loss of 1R transformer. Entered 6 hour LCO per Tech Spec 3.0 and 72

hour LCO per Tech Spec 3.1.A.b.2 for 11 RCP and 12 RCP out of service due to 1R transformer lockout caused by explosion of 1M transformer.

1311:30 - 11 Cooling Water pump stopped due to loss of power on Bus 13 and 121 Cooling Water pump auto started.

Approximately equal to 1311:34 - 480V Buses 190, 310 and 320 transfer to the bus tie. These buses are re-energized from Unit 2 480V buses through their respective bus ties.

1311 - The control room is notified of the fire/explosion of 1M transformer. The control room announced the fire near 1M transformer and dispatched the Plant Fire Brigade and notified the Red Wing Fire Department.

1312 - The control room announced the Unit 1 reactor trip

1315 - NRC Resident Inspectors, who witnessed the 1M transformer explosion, arrived in the control room. NRC Resident Inspector contacted and informed the Region 3 Branch Chief of the 1M transformer explosion and Unit 1 Reactor trip.

1316 - Control room makes an announcement directing the Plant Fire Brigade to assemble outside the Plant Nurses office which is located on the 695' level of the Old Admin building. The Fire brigade Chief held a brief tailgate session with brigade members to discuss the plan of attack before proceeding to the fire scene.

Approximately equal to 1319 - Plant Fire Brigade starts applying Aqueous

H:

Film Forming Foam (AFFF) using a 1.5 inch fire hose on the burning oil.

The initial ground fire had flames approximately 40 feet high with dense black smoke.

1321 - Due to loss of power to the Unit 1 Reactor Make Up pumps (powered from 480V buses 130/140), Unit 1 Charging pump suction supply was transferred to the Unit 1 Refueling Water Storage Tank (RWST) until power was restored (approximately 20 minutes) to the pumps.

TEXT PAGE 7 OF 13

Approximately equal to 1325 - The Plant Fire Brigade completes extinguishing the oil fire. The fire was extinguished using approximately 8 gallons of foam concentrate and 300 gallons of water.

1335 - The Red Wing Fire Department and ambulance arrive on site. The fire truck and ambulance were not brought into the protected area because the fire was out before they arrived.

1340 - Shift Manager declared a Notification of Unusual Event (NUE) based on Initiating Condition 20A, Conditions that warrant increased awareness on the part of plant operation staff or state and/or local offsite authorities.

Approximately equal to 1342 - Plant Manager arrives in Control Room and assisted the Shift Manager with Emergency Plan duties.

1400 - Unit 1 Letdown diverted to the Volume Control tank due to Hi temperature.

1405 - Plant Manager made plant page announcing Notification of Unusual

Event being declared based on explosion of 1M Transformer.

1410 - Environmental and Regulatory Affairs Department personnel contacted the Minnesota Duty Officer and the Minnesota Pollution Control Agency and informed them of the oil spill.

1412 - NRC Operations Center was notified of event via ENS phone.

1421 - Control room operators unblocked the Hi Flux at Shutdown alarm.

1423 - The Shift Emergency Coordinator (SEC) and Emergency Planner conducted the first NUE update to state and local government contacts.

Offsite contacts were informed that Initiating Condition #17D, Visually observed evidence of an unplanned or unexplained explosion within owner controlled fence but not affecting plant safe operation, was also met.

1430 - Per a request from the turbine system engineer operators started manually dumping the hydrogen from Unit 1 generator and injecting the emergency carbon dioxide system per 1C22.1 AOP1.

Approximately equal to 1435 - Started procedure 1C20.5, Unit 1-4.16KV System, to provide power to 4KV Buses 13 & 14 from 2RY. Opened all breakers on Bus 13 & 14 and closed Breaker 12RYBT, Bus tie Bus 1RY-N/Bus 2RY-N.

TEXT PAGE 8 OF 13

1438 - Closed Breaker 13-1, Bus 13 Source From 1RY XFMR, re-energizing Bus 13 from 2RY transformer.

1440 - Closed Breaker 14-1, Bus 14 Source From 1RY XFMR, re-energizing Bus 14 from 2RY transformer.

Per procedure 1C20.6, Unit 1-480V System, closed Breaker 13-3, "Bus 13 Feed To 103-105-109-301 XFMR" (re-energizing 480V buses 130 and 150 and, through the 480V bus ties, 14 Feed To 104-106-108-302 XFMR re-energizing 480V buses 140 and 160) and Breaker 14-2, "Bus 14 Feed To 104-106-108-302 XFMR" (re-energizing 480V bus 180).

1449 - Reset the Fire Alarm panel.

1521 - Completed SP-1118, Verifying Paths to Unit 1 Grid.

1525 - Drained and pressurized the pressurizer relief tank per C4.

1528 - Opened 1GT 345KV disconnect per 1C1.3 & 1ES-0.1 for isolating 1GT and 1M transformers from the substation to allow restoration of the substation ring bus.

1533 - Opened 1M 20KV disconnect per 1C1.3 and 1ES-0.1 for isolating 1M transformer from the Unit 1 generator and 1GT.

1535 - Reset relays on panel 1G per 1ES-0.1.

1536 - Reset substation lockouts for 1GT transformer per 1ES-0.1.

1540 - Engaged 8H16B & 8H17 B1 motor operated disconnects (MODs).

1557 - Closed Breaker 8H16 & 8H17 MODs. Opened 1RX disconnect to isolate 1R transformer X winding from buses 11 and 12.

1600 - Plant Manager conducts a strategy update meeting in the Tech Support

Center (TSC) with the various event support
ATTACHMENT 1 TO 9902120157 PAGE 1
OF 1

NSP Northern States Power Company

Prairie Island Nuclear Generating Plant

1717 Wakonade Dr. East

Welch, Minnesota 55089

February 4, 1999 10 CFR Part 50

Section 50.73

U S Nuclear Regulatory Commission

Attn: Document Control Desk

Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Docket No. 50-282 License No. DPR-42

Docket No. 50-306 License No. DPR-60

LER 19901, Unit 1 Reactor Trip Following

Failure of the Station Auxiliary Transformer

The Licensee Event Report for this occurrence is attached. In the report, we made no new NRC commitments. This event was reported via the Emergency Notification System in accordance with 10CFR50.72 on January 5, 1999. Please contact us if you require additional information related to this event.

Joel P. Sorensen

Plant Manager

Prairie Island Nuclear Generating Plant

c: Regional Administrator - Region III, NRC

NRR Project Manager, NRC

Senior Resident Inspector, NRC

Kris Sanda, State of Minnesota

Attachment

*** END OF DOCUMENT ***
